

9-4 Variation

Direct Variation--"y varies directly as x"

$$y = kx \quad k \text{--constant of variation}$$

$$k \neq 0 \quad x \neq 0$$

WS p535

1. $y = kx$ $y = \frac{3}{2} \cdot 8$

$$\frac{9}{2} = k \cdot 6 \quad y = 12$$

$$\frac{3}{2} = \frac{1}{6} = k$$

$$\frac{9}{6} = \frac{y}{8} \quad y = 12$$

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2. $y = kx$ $9 = \frac{1}{3}x$

3. $5 = k \cdot 15$ $27 = x$

$$\frac{1}{3} = k$$

Ex:

Circumference varies directly as diameter.

$$C = 25.133 \text{ when } d = 8$$

What is the constant of variation?

$$C = k \cdot d \quad C = \pi d$$

$$25.133 = k \cdot 8$$

$$3.1415 = k$$

Joint Variation--"y varies jointly as x and z"

$$y = kxz \quad k \neq 0 \quad x \neq 0 \quad z \neq 0$$

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5. $y = kxz$

$$18 = k \cdot 3 \cdot 2$$

$$3 = k$$

$$y = 3 \cdot 5 \cdot 3$$

$$y = 45$$

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6. $y = kxz$

$$y = \frac{3}{4} \cdot 6 \cdot 8$$

$$y = 36$$

$$6 = k \cdot 4 \cdot 2$$

$$\frac{3}{4} = k$$

Ex:

The area of a certain shape varies jointly as the base and height.

If $A = 24$ when $b = 6$ and $h = 8$, find the area when $b = 10$, and $h = 6$

$$\begin{aligned}
 A &= k b \cdot h \\
 24 &= k \cdot 6 \cdot 8 \\
 \frac{1}{2} &= k \\
 A &= \frac{1}{2} b h \\
 \frac{1}{2} 10 \cdot 6 \\
 A &= 30
 \end{aligned}$$

Inverse Variation--"y varies inversely as x"

$$y = \frac{k}{x}$$

Ex:

Time varies inversely as rate.

$$\begin{aligned}
 t &= \frac{k}{r} \\
 r t &= k
 \end{aligned}$$

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$$\begin{aligned}
 1. \quad y &= \frac{k}{x} \\
 12 &= \frac{k}{10} \\
 120 &= k \\
 y &= \frac{120}{15} \\
 y &= 8
 \end{aligned}$$

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$$\begin{aligned}
 2. \quad y &= \frac{k}{x} \\
 9 &= \frac{k}{45} \\
 405 &= k \\
 y &= \frac{405}{27} \\
 &= 15
 \end{aligned}$$

SWIMMING For Exercises 10–13, use the following information.

When a person swims underwater, the pressure in his or her ears varies directly with the depth at which he or she is swimming.



10. Write an equation of direct variation that represents this situation.
11. Find the pressure at 60 feet.
12. It is unsafe for amateur divers to swim where the water pressure is more than 65 pounds per square inch. How deep can an amateur diver safely swim?

$$\begin{aligned}
 p &= k \cdot d \\
 4.3 &= k \cdot 10 \\
 .43 &= k \\
 p &= .43d \\
 65 &= .43d \\
 151.2 &= d \text{ ft} \\
 p &> .43(60) \\
 &25.8
 \end{aligned}$$

The time it takes you to get to the city varies inversely as your driving speed. Averaging 20 miles per hour in bad traffic, it takes you 1.5 hours to get to the city. How long would the trip take averaging 50 miles per hour?

$$\begin{aligned}
 t &= \frac{k}{r} & t &= \frac{30}{50} \\
 30 &= k & & 36 \text{ min}
 \end{aligned}$$

HW

p496-497

23-39odd, 38, 47, 49-52